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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/820,695	03/30/2001	Si Yi Li	015290-500	4162
21839	7590	09/27/2005	EXAMINER	
BUCHANAN INGERSOLL PC (INCLUDING BURNS, DOANE, SWECKER & MATHIS) POST OFFICE BOX 1404 ALEXANDRIA, VA 22313-1404			OLSEN, ALLAN W	
			ART UNIT	PAPER NUMBER
			1763	

DATE MAILED: 09/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 09/820,695	<b>Applicant(s)</b> LI ET AL.	
	<b>Examiner</b> Allan Olsen	<b>Art Unit</b> 1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2005.  
2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-3,5-7 and 9-25 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-3,5-7 and 9-25 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 01 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>7/6: 9/2</u> . | 6) <input type="checkbox"/> Other: _____  |

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## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 2, 2005 has been entered.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1, 3, 5, 6, 9-13, 15, 16, 19-21 and 25 are rejected under 35 U.S.C. 102(a) as being anticipated by US Patent 6,090,304 issued to Zhu et al. (hereinafter, Zhu). See: abstract; column 2, line 65; column 4, lines 27-30; column 5, lines 38-53; column 6, lines 20-41; column 7, lines 2-6; and column 8, lines 5-10.

Claims 1, 3, 5, 6, 7, 9-13, 15-17, 19-21 and 25 are rejected under 35 U.S.C. 102(a) as being anticipated by US Patent 6,117,786 issued to Khajehnouri et al. (hereinafter, Khajehnouri). See: abstract; column 3, lines 25-30; column 4, lines 30-35; and column 5, lines 2-5.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khajehnouri as applied to claim 1 above in view of US Patent 6,251,770 issued to Uglow et al.

Khajehnouri teaches an underlying layer of silicon nitride but does not teach an underlying layer of silicon carbide.

Uglow teaches that underlying barrier layers are typically SiN or SiC.

It would have been obvious to one skilled in the art to replace Khajehnouri's SiN barrier with SiC because Uglow teaches that SiC and SiN are functionally equivalent in this regard.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khajehnouri as applied to claim 1 above.

Khajehnouri does teach filling the contact holes with metal.

It would have been obvious to one skilled in the art to fill the contact holes with metal because the entire purpose of forming a contact hole is to provide a means to make electrical contact to an underlying layer and this is typically done by filling the hole with metal.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khajehnouri as applied to claim 1 above.

Khajehnouri does not explicitly teach the use of an etchant that consists essentially of C<sub>5</sub>F<sub>8</sub>, N<sub>2</sub> and Ar.

It would have been obvious to one skilled in the art to use C<sub>5</sub>F<sub>8</sub> in place of C<sub>4</sub>F<sub>8</sub> in the etchant because Khajehnouri teaches using perfluorocarbons with the general formula of C<sub>n</sub>F<sub>m</sub> where n is at least 2 and m is greater than n. Khajehnouri cites C<sub>3</sub>F<sub>6</sub> and C<sub>4</sub>F<sub>8</sub> as examples but the extension to C<sub>5</sub>F<sub>8</sub> is obvious because there would be no point in providing a general formula of C<sub>n</sub>F<sub>m</sub> if the only envisaged fluorocarbons were the two that were explicitly cited. C<sub>5</sub>F<sub>8</sub> is obvious because it is only the second next higher order fluorocarbon that meets the conditions of the general formula, and as is evident in much of the prior art already of record, C<sub>5</sub>F<sub>8</sub> is well known as an etchant and It is considered to be a functional equivalent of C<sub>4</sub>F<sub>8</sub>.

Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6,506,680 issued to Kim et al. (hereinafter, Kim) in view of US Patent 6,284,149 issued to Li et al. (hereinafter, Li).

Kim teaches plasma etching a low k dielectric a perfluorocarbon such as C<sub>4</sub>F<sub>8</sub>. Kim teaches that a fluorohydrocarbon such as CH<sub>2</sub>F<sub>2</sub> may be added to the C<sub>4</sub>F<sub>8</sub>. Kim teaches that N<sub>2</sub> may be added to the C<sub>4</sub>F<sub>8</sub>/CH<sub>2</sub>F<sub>2</sub> mixture.

Kim does not teach that the amount of CH<sub>2</sub>F<sub>2</sub> should not exceed the amount of C<sub>4</sub>F<sub>8</sub>. Kim does not teach a CF gas to N<sub>2</sub> flow ratio. Kim does not teach using a dual RF frequency plasma reactor.

Li teaches a process similar to that of Kim's. Li teaches adding a substantial amount of N<sub>2</sub>, and Li provides example in which the flow rate of N<sub>2</sub> far exceeds the claimed minimum. Li teaches the etching gas into a plasma with the application of multiple RF frequencies (figure 8; column 8, lines 51-53 and column 9, lines 2-5).

It would have been obvious to one skilled in the art to use no more CH<sub>2</sub>F<sub>2</sub> than C<sub>4</sub>F<sub>8</sub> because Kim teaches that C<sub>4</sub>F<sub>8</sub> may be used alone or with CH<sub>2</sub>F<sub>2</sub> and as such the skilled artisan would view C<sub>4</sub>F<sub>8</sub> as the primary gas that is supplemented with CH<sub>2</sub>F<sub>2</sub>. It would have been obvious to one skilled in the art to use a CF gas flow rate that did not exceed 30 % of the N<sub>2</sub> flow rate because Kim is silent in regard to the N<sub>2</sub>:CF gas ratio and Li teaches that using substantial amount of N<sub>2</sub> prevents retrograde etching. Furthermore, N<sub>2</sub> is often used as a diluent and it is typical to use a large excess of a diluent as this provides a greater degree of control over a process. It would have been obvious to one skilled in the art to use the dual frequency apparatus of Li

because Kim is silent in this regard and Li teaches that the dual frequency apparatus provides good control over a process that is similar to Kim's.

***Response to Arguments***

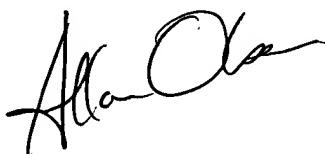
Applicant's arguments have been considered but are moot in view of the new grounds of rejection.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M-F 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Allan Olsen  
Primary Examiner  
Art Unit 1763